21 December 2007

M E M O R A N D U M

TO: Thomas Rackow, P.E.
Idaho Falls Regional Office

FROM: Tina Kurtz, Scientist I
Technical Services

SUBJECT: Idaho National Laboratory Reactor Technology Complex Cold Waste Pond Wastewater Reuse Permit Application Review -- LA-000161-01 (Industrial Wastewater Facility)

1.0 Purpose

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.17.400 (Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater) for issuing wastewater reuse permits. It states the principal facts and significant questions considered in preparing the draft permit conditions or intent to deny, and a summary of the basis for approval or denial with references to applicable requirements and supporting materials.

2.0 Project Description

The Idaho National Laboratory (INL) is located on approximately 890 square miles of high desert terrain in southeastern Idaho. The Lost River, Lemhi, and Beaverhead mountain ranges border the facility on the north and northwest. The eastern border of the INL is approximately 25 miles west of Idaho Falls, Idaho.

The Reactor Technology Complex or RTC (formerly the Test Reactor Area) is located in the southwestern portion of the INL on approximately 100 acres. The facility is comprised of 73 buildings and conducts research associated with developing, testing, and analyzing materials used in nuclear and reactor applications as well as both radiological and non-radiological laboratory analyses. The existing cold waste pond was constructed in 1982 and is located approximately 450 feet from the southeast corner of the RTC compound and 1 mile west of the Lost River channel. In addition to the Cold Waste Pond the facility also currently operates a Warm Waste Evaporation Pond as well as a Sewage Evaporation Pond (INL, 2006).

The United States Department of Energy- Idaho Operations (DOE-ID) owns the facilities at the RTC, including the Cold Waste Pond (CWP). The Management and Operation contractor, currently Battelle Energy Alliance, LLC, is responsible for the operations of the CWP.

The wastewater which is being discharged to the CWP consists primarily of non-contact cooling tower blow-down, once-through cooling water for air conditioning units, coolant water from air compressors, secondary system drains, and other non-radioactive drains throughout the RTC. The cold wastewater is normally routed through collection piping to the TRA-764 Cold Waste Sample Pit, where the flow rate is recorded and grab samples are collected for water chemistry analysis. The wastewater then flows to the cold waste sump pit (TRA-703) where submersible pumps route the water to the appropriate CWP cell through 8-inch valves.

Wastewater then enters the pond through concrete inlet basins located near the west end of each pond where the majority of the water percolates into the porous ground within a short distance from the inlet basins. The CWP consists of two cells, each with dimensions of 180 feet by 430 feet across the top of the berms, and a depth of 10 feet. The total surface area for the two cells is approximately 3.55 acres and their maximum capacity is approximately 10.2 million gallons (MG) or 31.3 acre-feet (ac-ft). Typically only one cell is in use at a time although the capability does exist to utilize both at once. The entire floor of a cell is rarely submerged; if the water level rises above 5 feet in a cell the flow is diverted to the adjacent cell, allowing the first to dry out. An overflow pipe connects the two cells at the 9 foot level (INL, 2006).

3.0 Summary of Events

The CWP was built in 1982 as a replacement for the Test Reactor Area Disposal Well, which injected the cold wastewater directly in the Snake River Plain Regional Aquifer. Since its construction, an average of 220 MG of process wastewater has been discharged to the pond each year. The facility has never specifically been issued a wastewater reuse permit to operate the CWP; the initial permit application for the facility was submitted in January of 1997. DEQ authorized the operation of the CWP until such time as a permit could be issued. A revised permit application was submitted in June of 2006.

4.0 Discussion

The following is a discussion of: ground water, soils, hydraulic management unit configuration, wastewater flows and constituent loading, and the plan of operation. Conclusions and recommendations are also summarized in Section 5 below.

4.1 Ground Water

The facility is proposing the use of four (4) wells to determine compliance with the Idaho Ground Water Quality Rule at the CWP (TRA-03, TRA-07, USGS-65, and USGS-76). All four of the proposed wells are completed in the regional Snake River Plain Aquifer (SRPA), located approximately 480 feet below the site, rather than either the shallow or deep perched-water bodies that have formed as a result of infiltration from the various unlined ponds on the site. See Figure 1 for monitoring wells located at the site (Note: As TRA-03 is a production well, it is not included in this figure).

Given that aquifer flow is to the southwest, Well TRA-03 is virtually the only well in the area positioned to provide up/cross-gradient aquifer water quality data as it is located in the upper northeast corner of the facility, up-gradient of not only the CWP but the other former percolation ponds in the immediate area. However, as it is also one of the RTC's production wells rather than a monitoring well, there is some question as to how reflective its water quality is of actual ambient up-gradient concentrations, in part due to the fact that the well pumps from a greater depth than the others. Wells USGS-065, TRA-07, and USGS-076 are proposed to monitor the aquifer down-gradient of the CWP. USGS-076 most likely occupies a more cross/down-gradient position, and its water quality more closely resembles that of TRA-03 than either USGS-065 or TRA-07. See Table 2 for averages of the laboratory results for these wells from 2000-2005 and comparison with their corresponding Ground Water Quality Standard (IDAPA 58.01.11.200).

Table 2. Laboratory Results for Proposed Aquifer Wells (numbers in bold are greater than the Ground Water Quality Standards)

Parameter (mg/L unless otherwise noted)	TRA-03	TRA-07	USGS-065	USGS-076	Ground Water Quality Standard[b]
Alkalinity (total)	164	126	124	164	NA
Aluminum	0.0584 B	0.047 B,U	0.0373 U	0.0411 B,U	0.2
Antimony	0.00554 B,U	0.00614 B,U	0.0056 U	0.00734 U	0.006
Arsenic	0.00265 B,U	0.0028 U	0.0033 B,U	0.00232 U	0.05
Barium	0.55 B	0.0902 B	0.0492 B	0.0732 B	2.0
Beryllium	0.000158 U	0.000249 U	0.00031 U	0.000379 U	0.004
Boron	0.0257 B,U	0.0156 B	NA	0.0199 B	NA
Cadmium	0.000313 U	0.00131 U	0.00146 U	0.000457 U	0.005
Calcium	49.5	76.5	81.0	54.5	NA
Chloride	10.0	15.9	18.9	14.0	250
Chromium	0.00313 B,U	**0.144**	**0.123**	0.0106 U	0.1
Cobalt	NA	0.00114 B,U	0.00117 U	0.00098 U	NA
Conductivity (UMHOS/CM)	415	NA	632	441	NA
Copper	0.00489 B	0.00542 B,U	0.0037 U	0.00115 U	1.3
Fluoride	0.109 J	0.175 J	0.188 J	0.104 J,U	4.0
Iron	0.0128 B	0.051 B,U	0.101 U	0.015 U	0.3
Lead	0.00514 B,U	0.00249 B,U	0.0029 U	0.00285 B,U	0.15
Magnesium	17.2	19.0	17.9	18.4	NA
Manganese	0.000511 B,U	0.00084 U	0.000473 U	0.00112 B,U	0.05
Mercury	0.000047 U	0.000106 U	0.00013 U	0.0000735 U	0.002
Nickel	0.00069 U	0.00334 B,U	0.036 U	0.00338 B,U	NA
Nitrate + Nitrite	0.84 J	0.925	2.0	0.92	10.0
Nitrate	NA	1.29	1.57	1.1	10.0
pH	7.88	NA	7.94	8.00	6.5-8.5
Potassium	1.6 B	2.81 B	2.95	1.84 B	NA
Selenium	0.00281 U	0.00328 U	0.004 U	0.00301 U	0.05
Silica	19.9 J	11.6	NA	21.2	NA
Silver	0.00182 B,U	0.00131 U	0.00163 U	0.000868 U	0.1
Sodium	NA	13.0	14.2	10.45	NA
Sulfate	23.6	128	157	29.4	250
Zinc	0.0097 B	0.037 B	0.385	0.0857	5

a. Facility states that data was taken from the INL Environmental Data Warehouse.
b. IDAPA 58.01.11.200 Ground Water Quality Rule, Primary and Secondary Constituent Standards. NA= no applicable standard.
B- Value less than the contract-required detection limit, but greater than or equal to the instrument detection limit (metals analysis). Compound is found in the associated blank as well as in the sample (nonmetals analysis).
J- Estimated value
U- Analyte was analyzed for but not detected. Analyte result was below the contract-required detection limit.
NA- not analyzed.

Based on the data presented, the CWP effluent has contained sulfate since 1982, however, the sulfate levels in the regional aquifer have consistently remained below the ground water quality standard of 250 mg/L. Concentrations in the CWP wastewater itself, however, vary significantly, anywhere from 15 mg/l to 463 mg/l, with the 2000-2005 average being 263 mg/l (DOE, 2006); an average which is only slightly above the groundwater quality standard. The nearest down-gradient aquifer wells, TRA-07 and USGS-065, show some potential evidence of the CWP's sulfate influence, with sulfate concentrations approximately 100 mg/l higher than the up-gradient and cross-gradient wells, but still well below MCLs. Several of the perched aquifer monitoring wells, on the other hand, do show evidence of elevated sulfate levels. While the CWP is the most likely contributor of sulfate within the perched waters, it is also possible that a certain amount could be attributed to historic infiltration from the former Chemical Waste Pond, which was taken out of service in 1999, as elevated sulfate concentrations were detected in the Materials Test Reactor (MTR) test well near the pond (DOE, 2005).

The facility has been monitoring the distribution of the sulfate plume for a number of years and a comparison of regional well results from 1991 to the present indicates that not only have sulfate levels remained fairly consistent, but that concentrations appear to dissipate fairly rapidly down-gradient of the facility. Regional aquifer well, TRA-08, located approximately 2000 feet down-gradient of wells TRA-07 and USGS-065 shows minimal CWP sulfate influence, as sulfate levels are on average 74 mg/l lower, and only 52 mg/l higher than up-gradient well concentrations (DOE, 2005). See Figure 3 for sulfate distribution in the regional aquifer wells in 1991 and 2004. Although it is evident that the CWP does have some impact with regards to sulfate concentrations on the various underground waters, especially in the perched waters, this impact does not appear to be overly significant or particularly far-reaching. It is recommended that both the wastewater effluent and the regional aquifer wells continue to be monitored for sulfate and the possibility of further action be considered should the sulfate concentration of the CWP effluent change or there are significant changes in the monitoring well results. For the full text of this condition please refer to Section G of the draft permit.

It should also be noted that both TRA-07 and USGS-065 are exhibiting chromium levels above ground water standards. While both these wells are positioned to show direct impact from the CWP, based upon the analytical analysis of the pond's effluent, the source of this particular contamination does not appear to be the CWP since chromium levels in the wastewater are consistently below the ground water quality standard. Analytical results show that the highest concentrations of chromium are found in wells which are located northwest, or up-gradient, of the CWP, near the former Warm Waste Pond, Warm Waste Retention Basins, and the former Chemical Waste Pond. Particularly high concentrations of the constituent found in association with Strontium-90 in perched wells WSGS-055, USGS-054, USGS-070, and CWP-9 indicate the contamination can most likely be attributed to leakage from these ponds and their associated piping and sumps (DOE, 2005).

The majority (89%) of the chromium found beneath the RTC exists in the form of hexavalent chromium which is oxidized under environmental conditions to the highly mobile chromate anion. High motility, combined with hydraulic gradients which are susceptible to surface perturbations such as snow-melt runoff and variable loadings to the CWP, combine to shift chromium from the northwest to CWP's down-gradient wells. While it is hardly desirable to have regional aquifer wells with chromium concentrations above MCLs, these levels do not indicate an increase in the overall mass of contaminant present, rather a shift from one location to another. In addition, ten perched and seven aquifer wells at the RTC are being monitored on a semi-annual basis as part of the Record of Decision for Waste Area Group 2, Operational Unit 13 for a number of constituents, including chromium. Well Highway-3, located approximately 3-miles down-gradient of the facility on Highway 20/28, is included in these samplings. Over the past few years this well has consistently failed to show levels of chromium above background (DOE, 2006). Though these chromium levels are a concern, it is clear that the CWP is not the source of the contamination and that the situation is being actively monitored by a number of agencies as part of the facility's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities. Therefore, it is recommended that the SRPA wells not be monitored for chromium as it is appears that the CWP is not contributing to the elevated levels. The facility effluent, however, should continue to be monitored for the chromium and should there be any increase in the constituent concentration in the effluent, chromium sampling in the groundwater monitoring wells should be reconsidered.

This issue of cross-contamination raises the question of ground water monitoring within the perched waters affected by the CWP. The Ground Water Quality Rule, GWQR, (IDAPA 58.01.11), adopted in 1997, contains specific ground water quality protection requirements and the GWQR (IDAPA 58.01.11.007.15) defines ground water as any water of the state which occurs beneath the surface of the earth in a saturated geological formation of rock or soil. Under this definition, ground water would include perched formations; and beneath the RTC the perched water systems exceed ground water quality for a number of constituents. Based upon samplings of the perched water wells near the CWP, the majority of the water is new infiltration from the CWP mixed with residual contamination from a variety of historic sources (INL, 2006). This contamination, as well as the contamination in the aquifer below, can be attributed to the years of discharge to the various unlined waste ponds, leaks from buried pipes, surface spills, and the direct disposal of waste to USGS-53 and the RTC injection well. Under CERCLA, the sources of this contamination have been removed or isolated, but the natural attenuation and radioactive decay processes by which these contaminants are removed take time. It is the facility's concern that enough of these historical contaminants remain in the perched waters above the aquifer to make it difficult to distinguish between impacts from the CWP and the residual contamination; therefore, their proposed monitoring plan includes only wells located in the Snake River Plain aquifer. See Table 3 for averages from 2000-2005 of both the chromium and sulfate concentrations in the perched wells at the RTC.

Table 3. Contaminant concentrations in perched wells at RTC (numbers in bold are greater than the Ground Water Quality Standards)

Well	Depth (feet)	Sulfate (mg/L)	Chromium (filtered) (mg/L)
CWP-1	48.45-59.44	**283**	0.00427 B,U
CWP-2	45.95-52.00	95.8	0.000503 U
CWP-3	50.16-57.00	58.4	0.00221 B,U
CWP-9	34.3-64.45	0 U	0.000503 U
PW-10	103.02	**258**	0.0783
PW-11	109.75	162	0.0049
PW-12	85.40	23.6	0.0216 B,U
PW-13	71.52-89.97	20.2	0.0426 B,U
PW-8	69.55	127	0.00559 B,U
USGS-053	70.03	98.4	0.0215
USGS-054	66.01	101	0.0056 B
USGS-055	62.10	94.1	0.0581
USGS-060	68.58	100	0.00451 B,U
USGS-061	90.27	140	0.0114
USGS-062	136.57	142	0.00715 B
USGS-063	76.05	133	0.0094 B
USGS-066	183.90	155	**0.284**
USGS-068	83.74	**1160**	0.0663
USGS-069	79.45	87.5	0.00628 B,U
USGS-070	72.86	106	0.0135
USGS-073	87.48	89.5	0.0916

Facility states that data was taken from the INL Environmental Data Warehouse.
B- Value less than the contract-required detection limit, but greater than or equal to the instrument detection limit (metals analysis). Compound is found in the associated blank as well as in the sample (nonmetals analysis).
J- Estimated value.
U- Analyte was analyzed for but not detected. Analyte result was below the contract required detection limit.

According to the facility, both the shallow and deep perched-water bodies have formed in the vadose zone at the RTC primarily in response to infiltration of disposed wastewater to unlined ponds. Currently the CWP is the largest source of water to the perched-water zones; however, prior to its installation in 1982, the Warm Waste Percolation Pond, which ceased operation in 1993, was the principle source of infiltration. The shallow perched-water zone is located 50 ft below ground surface (bgs) and the deep perched zone is found between 140 and 200 ft bgs (INL, 2006).

The shallow perched zone has eleven monitoring wells; however, as water levels in both zones tend to fluctuate in relation to hydraulic loading rates at the CWP, only two have remained consistently wet (CWP-1 and CWP-9). The deep zone has a network of 17 wells which are monitored for contaminants of concern, such as chromium and selected radionuclides under the CERCLA Record of Decision (ROD) for Operational Unit (OU) 2-13. See Figure 2 for perched wells on the site.

It is clear that the years of high sulfate loadings from the CWP have contributed to the elevated levels of the constituent in both the shallow and deep perched waters. The chromium contamination also appears to be more marked in these sets of monitoring wells because while only one well (USGS-066) shows levels above the ground water quality standard; several of the wells show levels of chromium above the pond's average and maximum effluent concentrations. Due to a number of factors, including the variable discharge to the CWP, contaminant levels in the perched zone monitoring wells tend to fluctuate (DOE, 2005). While the vast majority of these contaminants can be attributed to historic sources that have since been remediated, their continued presence makes monitoring for compliance within the perched water zones impractical. Staff recommends that the proposed down-gradient wells USGS-65, TRA-07, and USGS-076, as well as TRA-08 and Middle-1823, be monitored for compliance twice per year (April and October) as a condition of the draft permit.

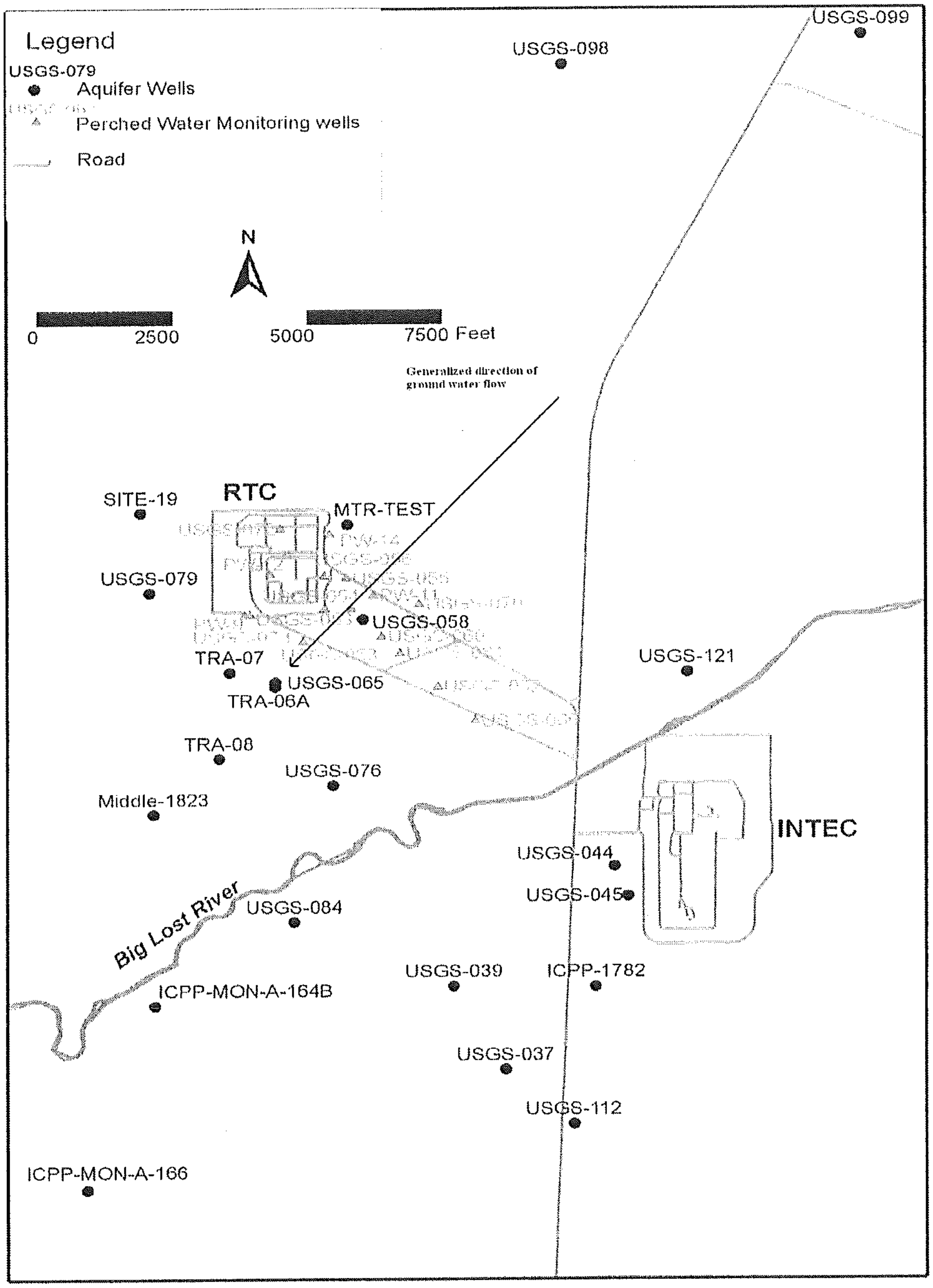

Figure 1. Aquifer and perched wells at the site, including proposed monitoring wells.

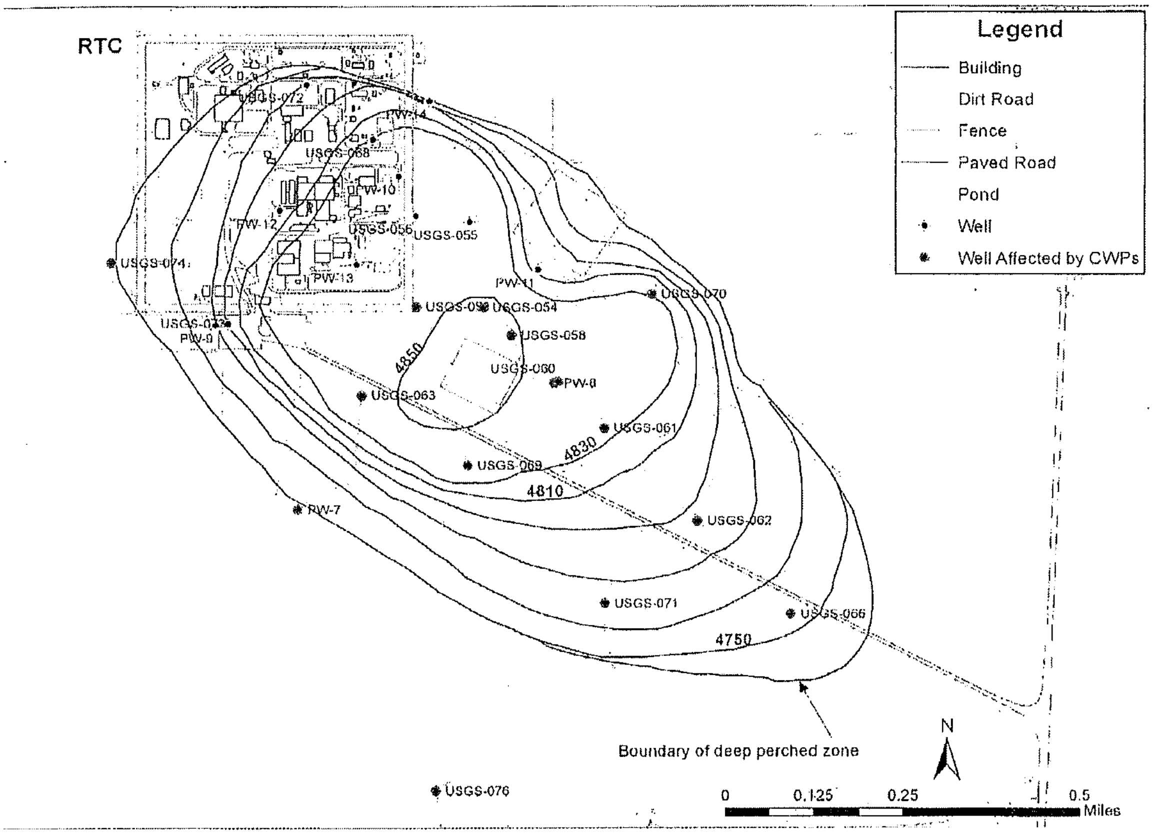

Figure 2. Deep perched water wells impacted by CWP

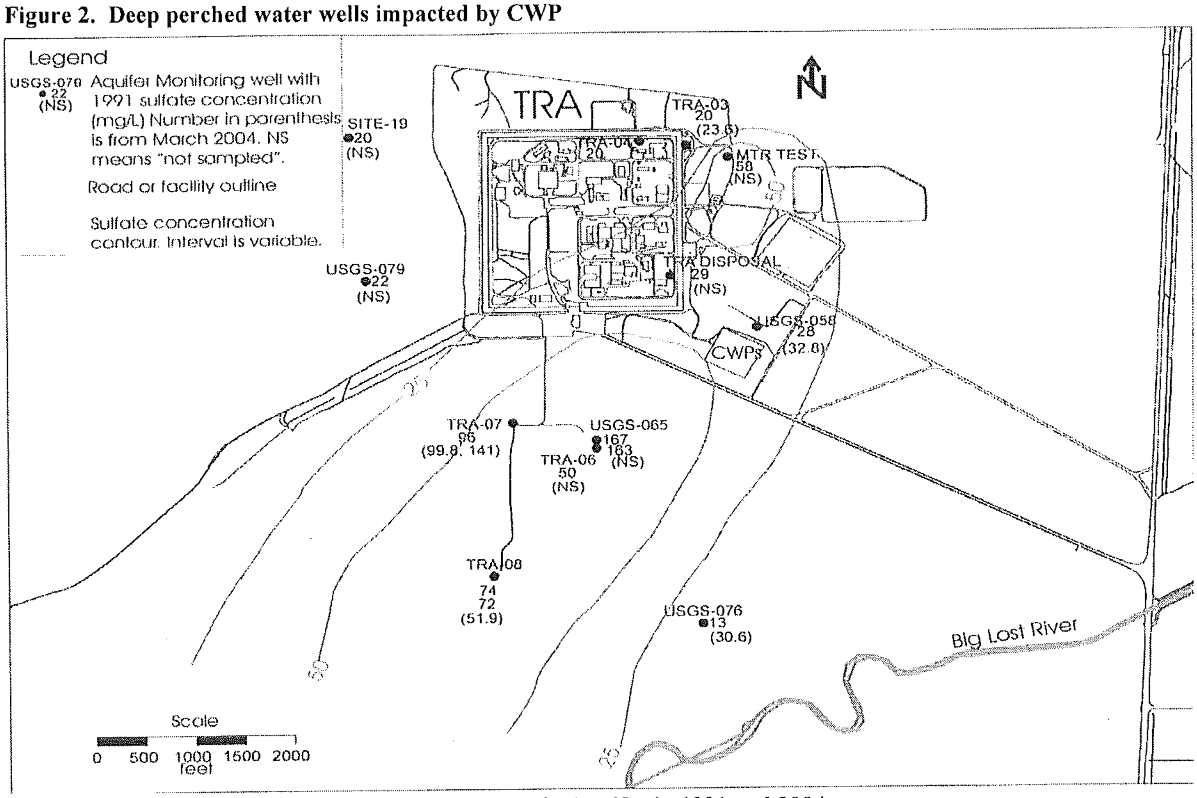

Figure 3. Sulfate distribution in the Snake River Plain Aquifer in 1991 and 2004.

4.2 Surface Water and Flood Zones

The majority of the INL is located in a topographically closed drainage basin known as Pioneer Basin where the Big Lost River, Little Lost River, and Birch Creek once drained from the mountain ranges to the west and north. (DOE-ID, 1992)

The Big Lost River channel is located approximately 4,480 ft from the southeast corner of the RTC security fence. According to the facility, actual river flow, however, reaches the INL fairly infrequently due to irrigation diversions and channel bed infiltration losses. The most recent Big Lost River flow observed to reach the INL occurred during the spring runoff of 2006; prior to that flows were observed in 2005, 2000, 1998, 1996, 1993, and 1987. When flow reaches the INL, it can be diverted by the INL Diversion Dam to four spreading areas to the west-southwest of the Radioactive Waste Management Complex (INL, 2006). The U.S. Geological Survey (USGS) monitoring sites at the INL confirm that the river has been dry since the end of July 2006, and has experienced only intermittent flow with levels ranging between 1 cubic foot per second (ft^3/s) and 450 ft^3/s during the last ten years (USGS, 2007).

There have been a number of studies which evaluate the potential effects of a 100-year flood event at the INL. The USGS study conducted by Hartness and Rousseau in 2003 estimates 100 year peak flow for the Big Lost River immediately upstream from the INL diversion dam, at 3,750 ft^3/s (Hartness and Rousseau, 2003). The DOE has accepted an alternate survey by the U.S. Bureau of Reclamation (Osteanna and O'Connell 2005) which puts the peak 100-year flood flow rate at 3,072 ft^3/s. The facility states that the ground surface elevation surrounding the CWP is approximately 4,920 ft above mean sea level (MSL), and the pond berms are 4,927 ft above MSL (INL, 2006). Therefore, according to either of the two most recent studies, the CWP could be considered outside the hypothetical 100-year floodplain. It should be noted however, that the combination of a 100-year peak flow event with an earthquake such as the Borah Peak earthquake of 1983 could significantly increase peak flow, thereby augmenting the potential for flooding at the site (Hartness and Rousseau, 2003).

4.3 Municipal Wells in Proximity to Facility

All water used at the RTC is derived from three aquifer production wells (TRA-01, TRA-03, and TRA-04) all of which are located in the northeast corner of the facility, up-gradient from both the current and former lined and unlined wastewater ponds. The INL itself is home to a total of twelve public water systems, one of which (INL Gun Range) is located approximately 3 miles southwest or down-gradient of the RTC and the percolation ponds. These wells are regulated by DEQ under IDAPA 58.01.08.

4.4 Geology and Soils

The area underneath the RTC overlies the eastern Snake River basalt plain, and consists of a complex stack of basalt flows intercalated with sedimentary deposits above a rhyolitic basement. The upper portions of these basalt and sediment layers are capped primarily with a thick section of surficial alluvial/fluvial deposits, which were laid down by the now-sporadic Big Lost River.

Due to the undulating nature of the basalt flow, the alluvium thickness varies somewhat throughout the site, with a depth of approximately 32 ft in the northwest section to 55 ft in the southern portion and a mean thickness of 49 ft. The basalt flows themselves, along with their accompanying sedimentary interbeds, extend to depths of 2,000 to 3,000 ft below land surface (bls) of the RTC (INL, 2006).

As no specific physical soil samples have ever been taken from directly beneath the CWP and the National Soil Conservation Service has not characterized the RTC site, the facility has included a general description of soil samplings taken throughout the RTC site, as well as the former warm waste percolation pond and retention basin. Generally speaking, soils throughout the site are described as well-to-poorly graded, sandy gravel to gravelly sand, with minor amounts of silt and clay. The greatest quantity of clay material lies at the interface between the surficial alluvium and the uppermost basalt unit; however, these units are by no means laterally continuous and also appear sporadically in the top 4 ft of the alluvium (INL, 2006).

While the physical properties of the soil beneath the CWP has never been characterized, a chemical analysis was performed on samples from the pond in 1990 for the Resource Conservation and Recovery Act (RCRA) toxic characteristic leaching procedure (TCLP) for metals and organic compounds (VOCs). Barium and several VOCs were detected at slightly elevated levels including: carbon tetrachloride at 0.006 mg/kg; total xylenes at 0.02 mg/kg; tetrachloroethene at 0.007 mg/kg; and 1,1,1,-trichloroethane at 0.38 mg/kg. The applicable contaminants were found to be below the TCLP regulatory levels, including barium whose concentration was reported as 0.66 mg/L (INL, 2006).

4.5 Wastewater Flows

As discussed above, the hydraulic management unit consists of a percolation pond with two cells, a total surface area of approximately 3.55 acres, and a maximum capacity of 10.2 MG. Since its construction in 1982, an average of 220 MG of process water has been discharged to the pond each year with a minimum of 143 MG in 1992 and a maximum of 318 MG in 2004. Between 1982 and 2004 a total of 5.1 billion gallons were discharged to the pond. During 2004, daily flows ranged from 288,000 to 576,000 gal. Current discharges to the pond are primarily driven by secondary cooling water requirements for the Advanced Test Reactor (ATR). While the flow to the pond is a combination of effluent from both continuous and intermittent processes, overall flow to the pond remains continuous as there is no capacity for storage in the cold waste drain system. The facility states future discharge volumes and flow rates are expected to continue to be similar to these historic levels (INL, 2006).

4.6 Constituent Loading Rates

The bulk of the wastewater discharged to the CWP consists of non-contact tower blow-down while a smaller portion consists of once-through cooling water for air conditioning units, compressors, secondary system drains, and other drains that do not receive radiologically contaminated water. As a result of this particular composition the levels for typical wastewater constituents such as phosphorus and nitrogen are fairly low. However, the facility does add commercial biocides and corrosion inhibitors to the cooling tower water, which effectively elevate several of the chemical properties of the effluent. Examples of the chemicals typically added include chlorine dioxide biocide generated by mixing sulfuric acid and sodium chlorate/sodium chloride, and phosphate-based corrosion inhibitors.

Between January 2000 and August 2004, the effluent to the pond was sampled for a variety of parameters including chloride, fluoride, nitrogen, aluminum, arsenic, cadmium, chromium, copper, iron, manganese, mercury, selenium, silver, sodium, sulfate, total dissolved solids (TDS), and total suspended solids (TSS), as well as several others. The average concentrations for the measured constituents all met ground water quality standards with the exception of TDS and sulfate. See Table 1 below for a summary of the test results in comparison with their corresponding ground water quality standard.

Table 1. Chemical properties of RTC Cold Waste Pond Effluent from January 2000 through August 2004

Parameter (mg/L unless otherwise noted)	Effluent Average[b,c]	Effluent Minimum[b,c,e]	Effluent Maximum[b,e]	#Samples/ #Detections[b]	Ground water Quality Standard[d]
pH	7.88	7.62	8.13	24/24	6.5-8.5
Chloride	23.73	8.60	34.5	24/24	250
Flouride	0.27	0.1	0.4	24/16	4
Nitrogen as Ammonia	0.0157	0.0157	0.0157	1/1	N/A
Nitrogen, nitrate+nitrate	2.05	0.97	3.2	24/24	10
Nitrogen, total Kjeldahl	0.546	0.05	3.97	18/12	NA
Sulfate	**263.11**	**15**	**463**	**24/24**	**250**
Total Dissolved Solids	**627**	**257**	**926**	**24/24**	**500**
Total Suspended Solids	4	1.4	7.3	19/2	NA
Aluminum	0.01756	0.0025 U	0.0437	24/11	0.2
Antimony	0.00093	0.0003 U	0.0017	24/10	0.006
Arsenic	0.00328	0.00125 U	0.005	24/17	0.05
Barium	0.09881	0.0472	0.138	24/24	2
Beryllium	ND	ND	ND	24/0	0.004
Boron	0.0635	0.0316	0.0756	6/6	NA
Cadmium	0.00041	0.00025 U	0.0015	24/1	0.005
Chromium	0.00701	0.0028	0.0105	24/24	0.1
Cobalt	ND	ND	ND	24/0	0.015
Copper	0.00385	0.0005 U	0.0095	24/20	1.3
Iron	0.05403	0.00625 U	0.109	24/15	0.3
Lead	ND	ND	ND	24/0	0.015
Magnesium	46.67	17.9	51.4	6/6	NA
Manganese	0.00166	0.0005 U	0.0117	24/2	0.05
Mercury	ND	ND	ND	24/0	0.002
Molybdenum	0.00908	0.0025 U	0.0157	6/5	NA
Nickel	0.00126	0.0005 U	0.0025	24/1	NA
Selenium	0.00189	0.001 U	0.0038	24/8	0.05
Silver	ND	ND	ND	24/0	0.1
Sodium	20.06	7.71	30.9	24/24	NA
Thallium	ND	ND	ND	24/0	0.002
Tin	ND	ND	ND	6/0	NA
Vanadium	0.00912	0.0043	0.0101	6/6	NA
Zinc	0.00357	0.00125 U	0.0135	24/11	5

a. The facility states that data was compiled from the Environmental Monitoring Information System (EMIS) database.
b. One-half of detection limit was used as an estimated concentration in the average calculation for those sample results that were below the detection thresholds. Rejected results are excluded from the average, minimum, and maximum values, but are included in the number of samples collected.
c. U—Concentration shown is one-half of the reported laboratory detection limit.
d. IDAPA 58.01.11.200 Ground Water Quality Rule, Primary and Secondary Constituent Standards. NA= no applicable standard.
e. ND—All historical results were reported as not detected, therefore no value is shown.

The Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater (IDAPA 58.01.17.06) state that rapid infiltration systems shall not exceed a maximum 30-day average concentration of 20 mg/L for total nitrogen and 100 mg/L for total suspended solids. As illustrated by Table 1 above, the total nitrogen concentrations from January 2000 through August 2004 ranged from 1.02 mg/L to 7.17 mg/L with an average of 2.6 mg/L; and the TSS concentrations ranged from 1.4 mg/L to 7.3 mg/L with an average of 4.0 mg/L. Based upon these estimations, staff does not anticipate that the nutrient loading from the effluent will exceed the previously stated limits or negatively impact concentrations in the ground water.

4.6.1 Total Dissolved Solids (TDS) Loading Rates

Total dissolved solids (TDS) loading rates from wastewater and irrigation water can have significant impacts to ground water TDS levels. Total dissolved solids measured in ground water are commonly inorganic constituents (salts). TDS in wastewater can include significant quantities of organic constituents in addition to salts, but in this case inorganic constituents predominate. The Idaho DEQ Ground water Quality Rule (IDAPA 58.01.11.200) identifies a numerical standard for TDS in ground water of 500 mg/L. TDS concentrations for the effluent discharged to the CWP from January 2000 to August 2004 ranged from 257 mg/L to 926 mg/L, with an average of 627 mg/L. While these effluent concentrations are in exceedance of the ground water standard for this secondary constituent, subsequent mixing in both the perched water zones under the CWP as well as in the regional aquifer may sufficiently dilute the constituent concentration. Staff recommends that the effluent be monitored on a monthly basis, and the ground water be sampled twice per year as a condition of the draft permit.

4.6.2 Sulfate Loading Rates

Ground Water Quality Rule (IDAPA 58.01.11.200) states that the concentration for sulfate should not exceed 250 mg/L. Sulfate concentrations for effluent, discharged to the CWP from January 2000 to August 2004, have ranged from 15 mg/L to 463 mg/L, with an average concentration of 263 mg/L (INL, 2006). While the effects of this constituent loading have contributed to elevated levels of sulfate in areas of the perched water zones, the wells sampled within the regional aquifer have remained below the ground water standard. Staff recommends effluent monitoring for this constituent on a monthly basis as a condition of the draft permit.

4.6.3 Hydraulic Loading Rates

As there is no storage capacity available in the system, wastewater flows to the CWP vary directly in relation to the processes at the RTC. The facility states that both hydraulic loadings and flow rates should remain generally unchanged. Given the historic loadings, as well as the projected flow rates used in recent perched-water modeling (DOE, 2005) staff recommends that the hydraulic loading limit be set at 300 MG per year. While this will inevitably perpetuate the existence of the perched-water zones underneath the RTC, it should not contribute to their expansion (DOE, 2005).

4.7 Buffer Zones and Site Management

The INL is a restricted facility with no public access located on 890 square miles of land; therefore, buffer zone requirements to private dwellings and public access areas are not applicable to this site. As a percolation pond system, grazing management and runoff control are also rendered irrelevant. Likewise, staff does not anticipate the need for any solids removal to take place in pond cells; thus, a Waste Solids Management Plan is not recommended at this time. If for some reason the facility determines that waste solids removal will be necessary during the life of the permit, Section H.4 of said permit still requires DEQ review and approval of a Waste Solids Management Plan prior to removal.

4.8 Plan of Operation

Section 1.0 of the Application (page 1) states that an updated facility plan of operation would be submitted after permit issuance, as an anticipated permit compliance condition.
It is understood that a plan of operation is a living document and is modified as operations and regulatory requirements change. Section E, Condition CA-161-01, as it appears in the draft permit (attached) requires the facility to submit a Plan of Operation for DEQ review and approval. For the full text of the condition, see Section E of the draft permit.

5.0 Conclusion

The following recommendations fall into two major areas. They include loading rate related recommendations and ground water related recommendations.

5.1 Loading Rate Related Recommendations

It is recommended that the annual hydraulic loading rate be set at 300 MG. See Section 4.2.2.3 for a more detailed discussion of hydraulic loading rates. It is also recommended that the effluent to the CWP be tested monthly for nitrate + nitrite nitrogen, total suspended solids (TSS), total dissolved solids (TDS), arsenic, barium, cadmium, chloride, chromium, cobalt, copper, fluoride, iron, manganese, mercury, selenium, silver, and sulfate.

5.2 Ground Water Related Recommendations

It is recommended that the ground water monitoring be performed in Wells USGS-065, TRA-07, USGS-076, TRA-08, and Middle-1823 twice yearly (April and October). Ground water should be tested for water table depth, water table elevation, pH, total Kjeldahl nitrogen (TKN), nitrite-nitrogen, total suspended solids (TSS), total dissolved solids (TDS), aluminum, antimony, arsenic, barium, cadmium, chloride, chromium, cobalt, copper, fluoride, iron, manganese, mercury, selenium, silver, and sulfate.

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